

## A STUDY OF THE SPECIES OF THE GENUS STENOPELMATUS FOUND IN THE UNITED STATES.

BY MORGAN HEBARD,

PHILADELPHIA, PA.

Brief examinations of the constantly increasing series of the genus in the Philadelphia collections have shown the futility of attempting to apply to these, with any satisfaction, the numerous names which have been proposed. Adding to these series the specimens in the United States National Museum, Museum of Comparative Zoölogy, Cornell University and other available collections, there is now before us sufficient material to undertake a revisionary study of the forms found north of the Mexican boundary.

Though little revisionary work of such character has been done since the erection of the present genus, the number of specific names, in the majority of cases based on few or unique specimens, has been constantly increasing. Scudder alone appears to have had before him series of any size, and his study of "The Stenopelmatinae of the Pacific Coast"<sup>1</sup> is clearly superficial.

With the undetermined material before us, we have nearly all which has been recorded by Scudder, Rehn, Caudell and Bruner. As a result, it is now possible to locate the specific units involved, and, in the accomplishment of this task, a number of interesting facts have become apparent, which should prove of decided value to subsequent work.

On the whole, however, the genus presents possibly the greatest number of difficulties to be found in any of the North American genera of Orthoptera. These may be summarized as follows:

In the species here considered, differential genitalic characters do not exist. In the males, from the nearly adult condition to maturity, a small stout incurved chitinous hook is found on each side of the supra-anal plate just proximad of the cerci (plate VII, fig. 16), this been represented in earlier instars by a low and rounded chitinous ridge<sup>2</sup> (plate VII, figs. 14 and 15). The supra-anal and subgenital

<sup>1</sup> Can. Ent., XXXI, pp. 113 to 117 (1899).

<sup>2</sup> This ridge is particularly conspicuous in the last of the instars in which the subgenital plate does not wholly conceal the inner genitalia. In the sub-

plates show no other specialization and are in general similar, while the structures within the anal orifice are soft, unmodified and in the different species always become greatly shrivelled in drying. In the females the supra-anal and subgenital plates show no specialization and are likewise in general similar, while the ovipositor is very short, simple, without teeth or roughened surface, and curved upward to the sharp apex of the dorsal valves.

Great dissimilarity in the sexes is shown in *S. longispina*. With little available material, the description of the male and female as distinct species can be readily understood. This feature is shown to a much less degree in the other species here considered.

The spination of the caudal tibiae, a feature slight variations in which have constituted the basis for descriptions of a number of nominal species, shows decided variability in *S. fuscus* and *S. longispina*, though respectively different averages are found in the number of spines and length of the distal spurs. Moreover, particularly in *longispina*, sexual differences are found in the caudal tibiae.

In all of the species here considered, as in the genotype, the tegmina and wings are absent. It is, partially due to this fact, exceedingly difficult to separate adults from individuals in the last instars preceding maturity.

A megacephalic condition is developed in certain species, of those before us much the strongest in *S. fuscus*, different individuals showing this feature to varying degrees. In the maximum of this condition found in *fuscus*, more usually encountered in the male sex, the head is enlarged out of all proportion to the body, this being particularly pronounced in the occipital region (plate VII, fig. 2). The eyes in such specimens sometimes differ in being decidedly protruding sequent stages to the adult condition, in all of which the subgenital plate is fully developed, these hooks are likewise fully developed. In consequence, the last stages of the immature condition, as is true also for the female sex, can only be distinguished through familiarity with the adult condition, which may be differentiated only through the more robust build and heavier structure particularly of the head, pronotum and limbs.

Brunner evidently compared an immature male of *S. talpa* with an adult male of *S. longispina*, at the time he described the latter species. (1888. Verh. zöol.-bot. Gesellsch. Wien, XXXVIII, p. 260.) A male specimen of *S. talpa* before us, from Mexico, shows the fully developed chitinous hook exactly as in the species here studied.

and bead-like, while the abnormal development of the head causes them to be unusually widely separated.

Very decided size variation frequently occurs, this is not geographic, though in series from the same general region, those from high elevations show shorter and heavier limbs to varying degrees. Certain individuals appear to be fully adult, but if so are astonishingly small. Other immature specimens, with genitalia showing them to be in early instars, are surprisingly large. It is evident from the series before us, that almost every instar may be found at the same time in the same locality. Until careful breeding experiments are made it will be impossible to determine exactly the life cycle of these singular insects,<sup>1</sup> to explain the great disparity in size frequently found in apparently the same instar and to distinguish readily the adult condition.

As to the Mexican species, we may state from examination of small series, that a number are extremely distinctive; that probably the most widely distributed of the species, *S. talpa*, should without doubt have a number of synonyms, and that, though the majority of the more northern species are certainly distributed southward beyond the Mexican boundary, none of the more southern species reach northward as far as that line.<sup>2</sup>

### **Stenopelmatus** Burmeister.

1838. *Stenopelmatus* Burmeister, Handb. der Entom., II, abth. II, pt. I, p. 720.

The genus was based on five species. GENOTYPE: *St[enopelmatus] talpa* Burmeister, selected by Kirby, 1906.<sup>3</sup>

#### KEY TO THE SPECIES OF THE GENUS STENOPELMATUS FOUND IN THE UNITED STATES.

(Vertex without carinæ. Head and pronotum not decidedly punctate. Tegmina and wings absent. Caudal limbs with tarsi much shorter than tibiæ. General coloration never black.<sup>4</sup>)

<sup>1</sup> The great preponderance of immature material in the collections before us suggests the possibility that more than a year is required in the transition from the egg to the adult condition.

<sup>2</sup> Records of *S. histrio* from the United States by Scudder and Rehn are all misidentifications, applying rightly to *S. fuscus* and *S. longispina*.

<sup>3</sup> Synon. Cat. Orth., II, p. 111.

<sup>4</sup> These features variously occur in certain Mexican species; some of them probably showing sufficient differentiation to warrant generic separation.

A. Size medium to very large. Occiput normally unicolorous, never heavily banded.

B. Size medium to large. Head less elongate, megacephalism frequently striking. Caudal limbs proportionately shorter. Caudal tibiæ broadening regularly without well-defined distal point of greatest width; dorsal margins normally armed with three external and five internal spines, none being deflexed and the more distal being usually longest; longest distal spur much shorter than, to nearly as long as, the metatarsus.

**fuscus** Haldeman.

BB. Size medium large to very large. Head more elongate, megacephalism not pronounced. Caudal limbs proportionately longer. Caudal tibiæ not broadening in male, broadening distad with well-defined point of greatest width in female; dorsal margins normally armed with two external and five internal spines, the broadening of the limb in the female causing the second external and fourth and fifth internal spines to be deflexed, the external and fifth internal spines being usually decidedly the smallest in both sexes; longest distal spur nearly as long as, to much longer than, the metatarsus. . . . . **longispina** Brunner.

AA. Size small. Occiput heavily marked with broad dark longitudinal bands. (Pronotum normally narrowing but little caudad. Caudal tibiæ showing a greatly modified development of the condition found in *longispina*; dorsal margins normally armed with two external and three internal spines; longest distal spur distinctly shorter than, to nearly as long as, the metatarsus) . . . . . **pictus** Scudder.

In using this key it is necessary to understand fully the difficulties presented by these species, these are considered both in the introduction and further discussed under each species in the present study. As we have remarked in other generic studies, no single character can be relied on for specific determinations. This is particularly true in the present genus, in which an unusual complexity of features is encountered. Differences in the number of caudal tibial spines, or slight variations in their position and relative length, are certainly unworthy of specific distinction; much of the past synonymy being mainly due to overestimation of the importance of variations in these features.

In addition to over 50 specimens previously recorded and some 40 now before us with insufficient data, all of which have been examined, we here record 195 specimens of the genus.

*Stenopelmatus fuscus* Haldeman. (Plate VII, Figs. 1 to 5.)

1852. *Stenopelmatus fuscus* Haldeman, Stansbury's Expedition to the Great Salt Lake, p. 372. [1 juv., Santa Fé, New Mexico; 1 juv., Chihuahua, Mexico.]

1869. *Stenopelmatus cephalotes* Walker, Cat. Dermapt. Saltat. and Suppl. Blatt. Br. Mus., p. 195. [♂, west coast of America.]

1872. *Stenopelmatus fasciatus* Thomas, U. S. Geol. Surv. Montana and adjacent Terr., 1871, Hayden (5th Ann. Rept. of Progress), p. 434. [♂, ♀: Wyoming; Utah; southern Idaho; Texas.]

1876. *Stenopelmatus oculatus* Scudder, Bull. U. S. Geol. Geogr. Surv. Terr., II, p. 261. [♂: Utah.]

1888. *Stenopelmatus hydrocephalus* Brunner, Verh. zoöl.-bot. Gesellsch. Wien, XXXVIII, p. 261. [♀, California.]

1897. *Stenopelmatus comanchus* Saussure and Pictet, Biol. Cent. Amer., Orth., I, p. 290. [♂, ♀: Durango, northern Mexico.]

We here select as type locality of *fuscus*, Santa Fé, New Mexico. The types have been destroyed, but before us are series from both Albuquerque and Jemez Hot Springs, New Mexico, nearby localities which safely prove the identity of Haldeman's species.

Though Walker's description of *cephalotes* is virtually worthless, Kirby has, through study of that type, placed Scudder's *oculatus* and Brunner's *hydrocephalus* under that name. That these names are absolute synonyms of *fuscus* (Scudder himself stated that his *oculatus* might not be distinct from *fasciatus* of Thomas, which is unquestionably synonymous with *fuscus*) we are convinced from study of the type of *oculatus*, the description of *hydrocephalus* and the series of undoubted *fuscus* before us.

Thomas' *fasciatus* we find, from the remaining specimens of his type series which are now before us, to be a synonym of *fuscus*.

Saussure and Pictet have described *comanchus* from specimens of the present species showing only minor differences in the spines of the caudal tibiae.

The present insect is the only species of the genus found in the United States from the eastern edge of the great plain to the Sierras. Adults are normally large, though not averaging as large as *S. longispina*. As we have remarked on page —, material in the instars preceding maturity shows the genitalia in both sexes in no way different from the adult condition; such material is here recorded as "nearly adult." As we have already stated, some of these examples are remarkably small and appear to indicate considerable size variation in

the species, others with genitalia in the unformed stages are sometimes quite large. At present the general heaviness and solidity of the limbs appears the only means of separating adults from some of the nearly adult examples.

In the present species megacephalism is often found in adults, particularly of the male sex. This is always accompanied by a proportionate broadening of the pronotum, which occurs principally in the cephalic portion. The unusually globose occiput, occasionally protruding bead-like eyes (normally very little protruding) and more than usually roughened exposed portion of the jaws, give individuals in which this condition has reached its maximum, a very singular appearance.

At high elevations in Texas, New Mexico, Arizona and apparently generally in southern California, the limbs are found to average somewhat stouter and shorter than in other portions of the insect's distribution. This feature is, however, decidedly variable. The limbs of *fuscus* average distinctly shorter and stouter than in *S. talpa* or *longispina*.

The caudal tibiæ have their dorsal surface very weakly convex to weakly concave, the spines vary from minute and delicate to stout and heavy, while the distal spurs also vary both in stoutness and in length. Normally the spines increase slightly in length distad, the fifth disto-internal spine being much smaller than the others only in the abnormal condition discussed in the next paragraph.

Some of the females before us from southern California show a striking abnormality in the greatly enlarged third spine of the dorso-internal margin of the caudal tibiæ, in extreme cases this spine being longer than any of the distal spurs. This feature is also shown by the series before us to exhibit great variability and though possibly indicating incipient racial development, has by no means reached a condition of sufficient stability to warrant nominal designation.

The spine count for the dorsal margins of the caudal tibiæ in the series before us is as follows:<sup>1</sup>

Number of spines, internal . . . . .	2-5	3-5	4-4	4-5	5-5	5-6	
Number of specimens . . . . .	1	2	8	19	89	5	
Number of spines, external . . . . .	2-3	2-5	3-3	3-4	4-4	4-5	5-5
Number of specimens . . . . .	5	1	74	28	14	1	1

<sup>1</sup> One specimen with a malformed limb has two instead of the normal three pair of distal spurs, the pair of much smaller disto-ventral spurs are represented by three minute spurs.



MEASUREMENTS (IN MILLIMETERS.)<sup>1</sup>

	Width of Head.	Width Be- tween Eyes.	Length of Pro- notum.	Width of Pro- notum.	Length of Caudal Femur.	Length of Caudal Tibia.	Longest Tibial Spur.	Length Caudal Meta- tarsus.
Males:								
Jordan, Montana . . . .	12	7.7	7.7	11.2	14.9	13.1	3.7	.....
Uva, Wyoming . . . . .	11.8	7.9	7.7	10.3	13.7	12.7	4.1	4.4
Cedar, Colorado . . . . .	.....	.....	7.1	10.7	12.5	12.1	4	4.1
Claudell, New Mexico	12.5	7.8	8.3	12.2	13.8	12.5	4.3	4.6
Salt Lake City, Utah.	11.3	7.6	7.7	10.7	13.7	12.6	4.1	4.7
Soldiers Home, Cal. . .	13.4	7.9	9.6	12.6	16	13.8	4.2	4.8
*Prescott, Arizona . . .	7	4.1	5.2	6.8	11.7	10.7	3.1	4.1
Females:								
Gebo, Montana . . . . .	11	7	7.2	10.2	12.8	12	3.6	4.2
Worland, Wyoming . .	10	6.6	6.8	9.7	12.2	11.4	3.3	4
Ogden, Utah . . . . .	11.1	7.1	7.6	11.2	13.3	12.2	3.2	4
Juarez, Mexico . . . . .	12.3	8	8.6	12.1	14.7	13.2	3.6	4.1
Reno, Nevada . . . . .	10.2	6.7	7.4	9.4	12.8	11.8	3.1	4.1
Sierra Madre, Cal. . .	11.2	6.7	8.7	10.7	14.2	12.7	3.2	4.2
*Wyoming <sup>2</sup> . . . . .	8.3	5.2	6	8	10.9	10	3	3.6
*Yakima, Washington	8.6	5.1	6.6	8.1	12	10.3	3.1	3.8
*Claremont, Cal. . . . .	8.7	5.2	6.3	8	11.4	10	2.3	3.2

The specimens marked with an asterisk in the instars are preceding maturity.

**Coloration.**—Head, pronotum, underparts and limbs warm buff, in many individuals suffused with ochraceous to differing degrees; the head often showing a more brownish-yellow coloring, a few very narrow and widely separated darker lines rarely indicated on the occiput. Abdomen shining blackish brown above, the caudal margins of the segments narrowly of the general warm buff coloration. In immature individuals, particularly those of deeper coloration, these bands are greatly reduced and are indistinguishable in several specimens before us which have shrivelled much in drying; on such specimens the description of *fuscus* was based.

**Distribution.**—Known northern limits from Jordan, Montana, westward to Yakima, Washington, and Drain, Oregon. The known limits of eastern distribution are Boxbutte County, and southwestern Nebraska; Claudell, New Mexico; El Paso, Texas, and Juarez, Mexico. In the latter country the extent of the species distribution is yet conjectural, though probably covering at least the greater portion of the northern plateau.

<sup>1</sup> We omit the body length, as the softness of the abdomen in the present genus precludes the possibility of accurate measurement.

<sup>2</sup> This specimen is one of the types of *S. fasciatus* of Thomas.

**Specimens Examined.**—In addition to a number previously fully and correctly recorded: 114; 13 males, 16 females, 31 immature males and 54 immature females.

Jordan, Custer County, Montana, X, 19, 1905 (G. F. Beebe), 1 ♂ [U. S. N. M.]

Gebo, Carbon County, Mont., XI, 22, 1899 (J. Johnson) 1 ♀ [Hebard Cln.]

Worland, Wyoming, IV and VIII, 1911 (L. Bruner), 2 juv. ♀ [Hebard Cln.]

Owl Creek, Hot Springs County, Wyo., VIII, 31, 1896 (R. P. Currie), 1 juv. ♀ [U. S. N. M.]

Uva, Wyo., IX, 8, 1898 (E. Boothroyd), 1 ♂ [Hebard Cln.]

Wheatland, Wyo. (Niswander), 1 ♀ [Hebard Cln.]

Laramie, Wyo. (Niswander), 1 ♀, 1 juv. ♂ [Hebard Cln.]

Wyoming, 2 nearly adult ♀, TYPES of *S. fasciatus* Thomas [U. S. N. M.]

Boxbutte County, Nebraska (J. G. Smith), 1 juv. ♂ [Hebard Cln.]

Hat Creek, Sioux County, Nebr., 1 very small juv. ♂ [Hebard Cln.]

Squaw Cañon, Sioux County, Nebr., VII, 1892, 1 juv. ♂ [Hebard Cln.]

Cedar, Colorado, VIII, 1910 (J. W. Wescott), 1 ♂ [A. N. S. P.]

Colorado, 2 ♂, 2 ♀ [Colo. State Dept. Agr. Cln. and U. S. N. M.]

Claudell, Roosevelt County, New Mexico, IX, 1911 (Mrs. P. Perkins), 1 ♂ [Hebard Cln.]

Jemez Hot Springs, N. M., III, 14, 1912 (J. Woodgate), 1 nearly adult ♀ [Hebard Cln.]

Albuquerque, N. M. (C. F. Wickham), 3 juv. ♂, 4 juv. ♀, 1 very small juv. ♀ [Hebard Cln.]

Kelly, Socorro County, N. M. (F. G. Schaupp), 2 juv. ♂ [U. S. N. M.]

Dripping Spring, Organ Mountains, N. M., IX, 1899 (T. D. A. Cockerell), 1 juv. ♀, 1 very small juv. ♂ [U. S. N. M.]

Fort Wingate, N. M., III, 12 to VI, 26, 1910 (J. Woodgate), 5 juv. ♂, 3 juv. ♀, 1 very small juv. ♂ [Hebard Cln.]; X, 15, 1907 (J. Woodgate), 1 juv. ♀<sup>1</sup> [A. N. S. P.]

<sup>1</sup> Recorded by Rehn as the synonymous *S. oculus*.



Black Range, Sierra County, N. M., VIII, 1915 (H. A. Pilsbry), 1 nearly adult? small ♂ [A. N. S. P.].

El Paso, Texas, 1908, 1 ♀ [U. S. N. M.].

Juarez, Chihuahua, Mexico, IX, 4, 1908 (D. E. Murray), 1 ♀ [Hebard Cln.].

Southern Idaho, 1 juv. ♀, TYPE of *S. fasciatus* Thomas [U. S. N. M.].

Snake River, Idaho, VIII, 21, 1883, 1 juv. ♀ [Hebard Cln.]; X, 1890, 1 ♀ [U. S. N. M.].

Springfield, Idaho, VIII, 23, 1906 (H. Skinner), 1 juv. ♀; 1 juv. ♀ [both A. N. S. P.]<sup>2</sup>

Pocatello, Idaho, 5,000 feet, VIII, 6, 1910 (Rehn and Hebard; dead on lowest mesa), 1 juv. ♂ [Hebard Cln.].

Yakima, Washington (C. V. Piper), 1 nearly adult ♀ [Hebard Cln.].

Umatilla, Oregon, VI, 24, 1882 (S. Henshaw), 1 juv. ♂ [Hebard Cln.].

Peterson, Utah, XII, 5, 1878 (L. Hirst), 1 ♀ [U. S. N. M.].

Odgen, Utah, X, 1909 (M. M. Childs), 1 ♀, 1 nearly adult ♀ [U. S. N. M.].

Salt Lake City, Utah, 1 ♂, 1 juv. ♂ [A. N. S. P.].

Reno, Nevada, 1 ♀ [Hebard Cln.].

Keani's District, Navajo Indian Reservation, Arizona, IV, 28, 1901 (A. W. Barber), 1 juv. ♀ [Hebard Cln.].

Grand Cañon, Ariz., VII, 12, 1892, 1 nearly adult ? small ♀ [Hebard Cln.].

Williams, Ariz., VII, 24 (Barber and Schwarz), 1 nearly adult ? small ♂ [U. S. N. M.].

Prescott, Ariz., VI, 14, 1904 (R. E. Kunze), 1 nearly adult ♂<sup>3</sup> [Hebard Cln.].

Phoenix, Ariz., IX, 16, 1903 (R. E. Kunze), 1 juv. ♀<sup>4</sup> [Hebard Cln.].

Carr Cañon, Huachuca Mountains, Ariz., VIII, 1905 (H. Skinner), 1 juv. ♀<sup>5</sup> [A. N. S. P.].

<sup>2</sup> Recorded by Rehn as the synonymous *S. fasciatus*.

<sup>3</sup> Recorded as the synonymous *S. oculatus* by Rehn.

<sup>4</sup> Recorded by Rehn as the synonymous *S. oculatus*.

<sup>5</sup> Recorded by Rehn as the synonymous *S. oculatus*.

Madera Cañon, Santa Rita Mountains, Ariz., V and VI, 1898 (E. A. Schwarz), 2 juv. ♂ [U. S. N. M.].

Sycamore Cañon, Baboquivari Mountains, Ariz., X, 8, 1910 (Rehn and Hebard; in "tinajas"<sup>6</sup>), 1 juv. ♂ [Hebard Cln.].

Monument 200, Yuma Desert, Ariz., III, 1894 (E. A. Mearns), 1 juv. ♀ [U. S. N. M.].

Chilcoat, California, IV, 25, 1915 (E. O. Essig), 1 juv. ♂ [Hebard Cln.].

Russian River, Cal., 1 ♂, 1 nearly adult ♀ [A. N. S. P.].

Marin County, Cal., 2 nearly adult ♀ [Cal. Acad. Sci.].

Santa Clara Valley, Cal., 1 juv. ♀ [Hebard Cln.].

Natoma, Cal., VII, 2, 1885, 1 juv. ♀ [U. S. N. M.].

Lone Pine, Cal., VI, 14, 1891 (A. K. Fisher), 1 juv. ♀ [U. S. N. M.].

Ft. Tejon, Cal., 2 ♂ [U. S. N. M. and Hebard Cln.].

Tehachapi, Cal., 4,100 feet, XII, 12, 1906, 1 nearly adult ♀, 1 juv. ♀, 2 very small juv. ♀ [Cornell Univ. Cln.].

San Luis Obispo, Cal., VI, 27, 1906 (A. N. Caudell; under cow droppings), 1 juv. ♂, 2 juv. ♀<sup>1</sup> [U. S. N. M.].

Guadaloupe, Cal., VI, 24, 1909 (A. N. Caudell), 1 juv. ♂<sup>2</sup> [U. S. N. M.].

Santa Barbara, Cal., I and II, 1876 (Osten-Sacken), 1 ♀ [M. C. Z.].

South Santa Monica, Cal. (J. J. Rivers), 1 nearly adult ♀ [Hebard Cln.].

Soldiers Home, Los Angeles County, Cal., XII, 1909 (J. H. Demarest), 1 ♂ [U. S. N. M.].

Pasadena, Cal. (H. W. Rust), 1 ♀<sup>3</sup> [A. N. S. P.].

Sierra Madre, Cal., V, 30, 1906 (A. N. Caudell; dead in field), 1 ♀<sup>4</sup> [U. S. N. M.].

<sup>6</sup> These are the natural water tanks found in the usually dry mountain stream beds in the desert regions of the southwestern United States. Several specimens in various stages of decay were found at the time in these pools, as well as the remains of individuals of a number of other species of Orthoptera.

<sup>1</sup> Correctly recorded by Caudell.

<sup>2</sup> Correctly recorded by Caudell.

<sup>3</sup> Recorded by Rehn as *S. californicus*.

<sup>4</sup> Correctly recorded by Caudell.

Claremont, Cal. (C. F. Baker), 2 nearly adult ♀, 1 very small juv. ♂<sup>5</sup> [Hebard and Cln. and U. S. N. M.].

Los Angeles County (D. W. Coquillett), 1 ♂, 1 juv. ♀ [U. S. N. M.].

San Bernardino, Cal. (G. W. Dunn), 3 nearly adult ♀, 1 juv. ♀ [Hebard Cln.].

Beaumont, Cal., 2,700 feet, IX, 28, 1910 (Rehn and Hebard; dead on adobe plain), 1 nearly adult ♀ [Hebard Cln.].

Mojave Desert, Cal., VII, 5, 1893 (Loew), 1 juv. ♀ [U. S. N. M.].

San Diego, Cal. (J. L. Lippincott), 2 ♀, 1 nearly adult ♀, 1 juv. ♀ [A. N. S. P.]; 2 nearly adult ♀, 2 juv. ♀, 1 very small juv. ♂ [Hebard Cln.]; VIII, 1900 (Marlatt), 1 juv. ♀ [Hebard Cln.].

Scudder's records of *fasciatus* and *oculatus* all apply to *fuscus*, of which species these names are synonyms. His records of *longispina* from San Diego, California, and of *irregularis* from Fort Tejon, California, are incorrect, being properly referable to *fuscus*.

***Stenopelmatus longispina*** Brunner. (Plate I, Figs. 6 to 9.)

XXXVIII, p. 260. [♂, Vancouver, British Columbia.]

1888. *Stenopelmatus californicus* Brunner, Verh. zoöl.-bot. Gesellsch. Wien, XXXVIII, p. 261. [♀, Vancouver, British Columbia.]

1888. *Stenopelmatus irregularis* Brunner, Verh. zoöl.-bot. Gesellsch. Wien, XXXVIII, p. 261. [♀, Mazatlan, Mexico; Arizona; California.]

1902. *Stenopelmatus terrenus* Rehn, Ent. News, XIII, p. 240. [[Juv.] ♀ (incorrectly), Texas.]

Typical material of the differently appearing sexes of the present species were described by Brunner, the male as *longispina*, the female as *irregularis*. Furthermore, it is evident that *californicus* is based upon a female in which the third and fourth internal spines of the caudal tibæ are not more widely separated than the others. This is simply a minor variant which occurs in a few specimens of several series before us. Rehn's name, *terrenus*, is based upon a typical immature female which has, however, been dried after immersion in alcohol, with pronotum more decidedly constricted caudad than usual as a result. The specimen probably came from California, having been obtained from the Cope collection of reptiles, where it had been doubtless incorrectly labelled. Another immature male specimen of

<sup>5</sup> Recorded, with a question, by Rehn as *S. californicus*.

1888. *Stenopelmatus longispina* Brunner, Verh. zoöl.-bot. Gesellsch. Wien,

the same size and from the same lot, correctly recorded by Rehn as *longispina*, bears the same labelling. From the series now at hand it is evident that the range of *longispina* does not extend far inland from the Pacific coast. Brunner's record of the synonymous *irregularis* from Arizona, will probably be found to apply to *S. fuscus*.

The present species is decidedly the largest known of the genus. In specimens of maximum size, the head is extremely large but no indication of an abnormally bulbous occiput or protruding eyes is shown, a condition frequent in *fuscus*. In the immature stages the head is not as large proportionately as in the adult and the pronotum in consequence does not expand as much cephalad. As discussed under *fuscus*, the later instars preceding maturity might easily be mistaken for the adult condition.

The caudal tibiæ have their dorsal surface very weakly concave, this varying slightly in different individuals. The spines and spurs, though varying somewhat both in length and position individually, are more constant than in *fuscus*. The normal form and armament of the caudal femora is best understood by reference to the figures (plate VII, figs. 8 and 9). The most frequent variation is, in the males, the fifth internal spine equal to or longer than the fourth and the presence often of small supplementary external spines; in the females, absence of the fifth internal spine and presence of small supplementary external spines. The length of the limbs and of their spurs shows considerable variation, the longest spur (dorso-internal) of the caudal tibiæ is, however, very rarely much shorter than the caudal metatarsus.

The spine count for the dorsal margins of the caudal tibiæ in the series before us is as follows:

Number of spines, internal . . . . .	2-5	3-4	4-4	4-5	5-5	5-6	5-7
Number of specimens . . . . .	1	1	25	6	51	6	1
Number of spines, external . . . . .	1-2	2-2	2-3	3-3	3-4	4-4	4-5
Number of specimens . . . . .	2	48	21	8	3	8	2

The specimens marked with an asterisk are probably in the instar preceding maturity.

**Coloration.**—Head, pronotum and limbs, antimony yellow. In dark individuals (apparently more often encountered in the female sex) the head and pronotum are mummy brown, the limbs strongly

## MEASUREMENTS (IN MILLIMETERS).

	Width of Head.	Width Between Eyes.	Length of Pronotum.	Width of Pronotum.	Length of Caudal Femur.	Length of Caudal Tibia.	Longest Tibial Spur.	Length Caudal Metatarsua.
Males:								
Berkeley, California..	11.4	7.3	9.8	10.8	19.2	18.9	6.9	5.7
*Drain, Oregon.....	7	4.8	6.2	7.2	13.8	13.2	4.3	4.7
*Marin County, Cal..	8.8	5.6	7.8	8.3	17.3	16.5	5.7	4.9
Females:								
Berkeley, California..	12.8	7.8	9.9	11.7	18.3	16.8	5.3	5
Berkeley, Cal.....	14.1	8.7	11	14	19.7	19	5.7	5
Menlo Park, Cal.....	12.2	7.2	10	12.1	17.9	17.2	4.7	5
Alameda County, Cal.	12.2	7.5	10.1	12.1	18.7	17.6	4.8	5.1
*San Francisco, Cal...	11.1	7	8.7	10.9	14.9	14.2	4.4	4.7

suffused with the same color. A paired transverse marking of tawny or russet is usually well indicated on the pronotum (plate VII, fig. 7). Abdomen shining blackish brown above, the caudal margins of the segments narrowly of the general coloration. The underparts are generally of the paler color. In dried immature examples, as in *fuscus*, the pale dorsal abdominal bands are often less apparent.

**Distribution.**—The present insect is known on the Pacific coast from Vancouver, British Columbia to the Mexican boundary. It has not been found but a very short distance inland, except at Drain and Roseburg, Oregon, and Sacramento, Lake Tahoe and San Bernardino, California. In Mexico, the species has been recorded from Mazatlan alone.

**Specimens Examined.**—In addition to a number previously fully and correctly recorded: 73; 1 male, 4 females, 25 immature males, and 43 immature females.

Baird's Ranch, Redwood Creek, Humboldt County, California, VI, 9, 1903 (H. S. Barber), 1 juv. ♂, 1 juv. ♀ [U. S. N. M.].

Samoa Beach, Humboldt County, Cal., VI, 18, 1907 (J. C. Bradley; in sand dunes), 1 juv. ♀ [Hebard Cln.].

Ukiah, Cal., IV, 1885 (J. H. Burke), 2 very small juv. ♂ [Hebard Cln.].

Sacramento, Cal. (E. O. Essig), 1 juv. ♀ [Hebard Cln.].

Lake Tahoe, Cal., IX, 7, 1 juv. ♂, 1 juv. ♀ [Hebard Cln.].

Eldridge, Cal. (J. A. Kusche), 1 large juv. ♂, 2 large juv. ♀, 2 juv. ♂, 1 juv. ♀, 4 small juv. ♂, 1 small juv. ♀, 2 very small juv. ♂, 2 very small juv. ♀ [Hebard Cln.].

Manzanito, Marin County, Cal., X, 27, 1906 (J. C. Bradley), 2 juv. ♀, 1 very small juv. ♂, 1 very small juv. ♀ [Cornell Univ. Cln.].

Marin County, Cal., 1 nearly adult ♂, 2 juv. ♂, 1 juv. ♀, 3 very small ♂ [Cal. Acad. Sci. and Hebard Cln.].

Martinez, Cal., I, 6, 1883 (H. W. Turner), 1 nearly adult ♀ [Hebard Cln.].

Berkeley, Cal. (J. Rivers), 2 ♀; III, 1906, 1 very small juv. ♀, X, 3, 1906, 1 ♂ (both J. C. Bradley) [all Hebard and Cornell Univ. Clns.].

Haywards, Cal., VI, 16, 1906 (F. E. Beal; in stump), 1 nearly adult ♀ [U. S. N. M.].

Alameda County, Cal., II, 1888 (G. W. Dunn), 1 ♀, 2 nearly adult ♀, 2 juv. ♀ [Hebard Cln.].

San Francisco, Cal. (E. Ehrhorn), 1 nearly adult ♀, 1 small juv. ♀ [Hebard Cln.]; (H. Edwards), 1 nearly adult ♀ [Cornell Univ. Cln.].

Menlo Park, Cal., 1905 (F. Hornung), 1 ♀, 4 juv. ♀, 1 small juv. ♀ [U. S. N. M. and Hebard Cln.].

Palo Alto, Cal., III, 1892, 2 juv. ♀, 1 small ♂, 2 small juv. ♀, 1 very small juv. ♀ [Cornell Univ. Cln.].

San José, Cal., 1 nearly adult ♀ [M. C. Z.].

Felton, Santa Cruz Mountains, Cal., V, 1907 (J. C. Bradley), 1 juv. ♂, 2 juv. ♀, 5 small juv. ♀ [Cornell Univ. Cln.].

San Bernardino, Cal. (G. W. Dunn), 1 nearly adult ♂ [Hebard Cln.].

San Diego, Cal. (J. Rivers; Blaisdell), 2 juv. ♂, 1 juv. ♀ [Hebard Cln.].

Scudder's records of *longispina*, *irregularis*, *californicus* and *histrion*, all apply properly to the present species, of which *irregularis* and *californicus* are synonyms, with the exception of the specimens mentioned at the end of the treatment of *S. fuscus* in the present paper.

Specimens of the present species, in the Academy of Natural Sciences of Philadelphia, have been recorded by Rehn as follows: as *histrion*, San Francisco, California, 1 small juv. ♂, 1 small juv. ♀; as *irregularis*, Santa Clara County, California, 1 very large juv. ♀, San Francisco, California, 1 very large juv. ♀; as *pictus*, San Francisco, California, 1 juv. ♂. The material in this series from San Francisco is all from the same lot collected by L. E. Ricksecker.



**Stenopelmatus pictus** Scudder. (Plate VII, Figs. 10 to 13.)

1899. *Stenopelmatus pictus* Scudder, Can. Ent., XXXI, p. 116. [1♂, ♀: California; San Francisco, California.]

We here select a single type the largest female from San Francisco, California.

This species is closely related to *S. longispina*, though of very decidedly different general appearance from the normal condition found in that species. The most striking features are: the very small size; distinctly and heavily marked occiput and pronotum, and reduced armament of the less strongly developed caudal femora, both in size of distal spurs in proportion to the metatarsus and average fewer number of spines on the dorsal margins. Certain series of *longispina*, in the later instars preceding maturity, and in consequence with genitalia as in the adult condition, closely resemble material of the present species. These agree in size and the more quadrate pronotum, but differ in the more slender form, usually more decided tawny pronotal marking (plate VII, fig. 7) slightly more elongate limbs and the other features which distinguish *longispina*, as discussed above.

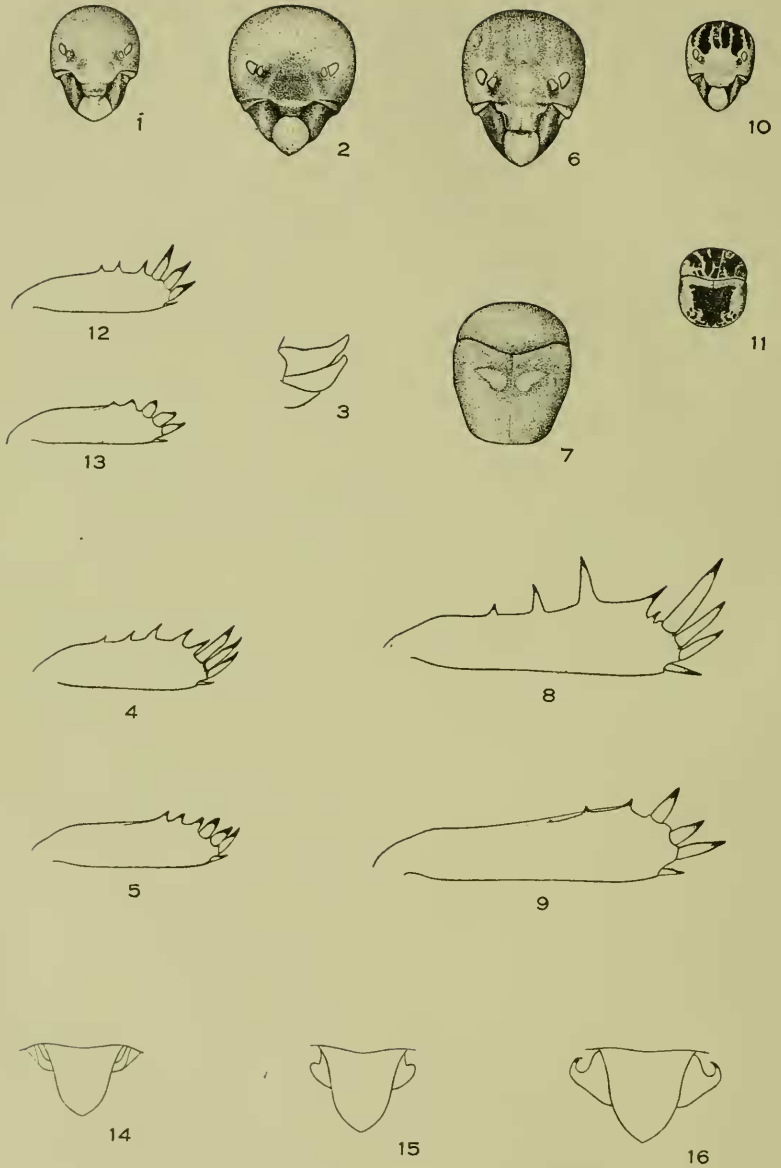
The caudal tibiæ have the dorsal surface weakly concave distad in the females, deplanate in the males. The males have the limbs distinctly longer than the females, this most pronounced in the caudal femora.

In the twelve known specimens of the present species, all now before us, the spine count for the dorsal margins of the caudal femora is the same: internal, 3 and 3; external, 2 and 2. The species is known from so few specimens that little can be ascertained as to its variability. Though variation doubtless occurs, if, as is indicated by the collections of Orthoptera made up to the present time, the present insect is decidedly limited in distribution, probably much less variation will be encountered than in the other widely distributed forms.

The measurements given above are all from material which shows genitalia of mature form. As such occurs, however, in individuals of the genus in the later instars preceding maturity, in the absence of larger series of the present species we are unable to state positively that these specimens are fully mature.

**Coloration.**—Head, pronotum, limbs and underparts, ochraceous buff. Dorsum of pronotum and occiput heavily marked with shining





*Stenopelmates.*